Technical training.
Product information.

F30 Chassis Dynamics

Edited for the U.S. market by:
BMW Group University
Technical Training
ST1113 12/1/2011

BMW Service

General information

Symbols used

The following symbol is used in this document to facilitate better comprehension or to draw attention to very important information:

Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left-hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as a result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

Contact: conceptinfo@bmw.de

The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

Information status: **September 2011**
VH-23/International Technical Training

F30 Chassis Dynamics

Contents

F30 Chassis Dynamics

Contents

F30 Chassis Dynamics

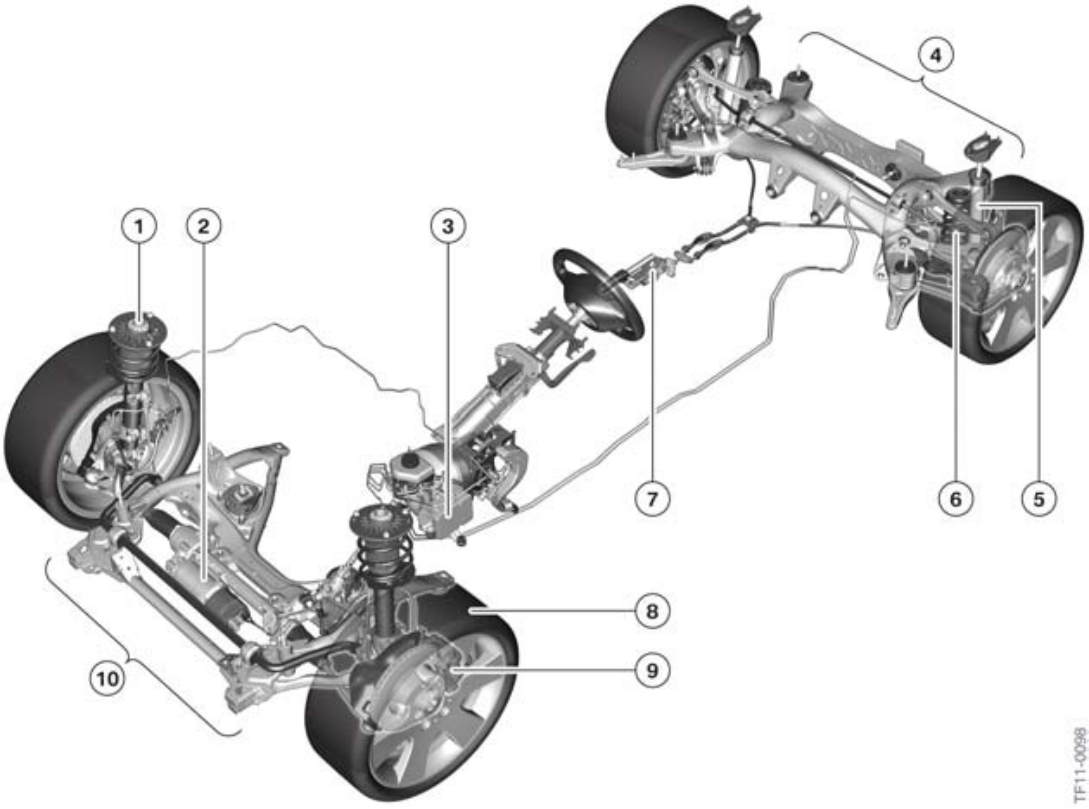
1. Introduction

1.1. Models

The F30 will be launched on the market in the following models in February 2012:

- BMW 328i
- BMW 335i

1.2. Driving dynamics and comfort



F30 Chassis and suspension

Index	Explanation
1	Suspension/dampers
2	Electronic Power Steering EPS
3	Dynamic Stability Control DSC
4	Five-link rear suspension
5	Damping action
6	Suspension

F30 Chassis Dynamics

1. Introduction

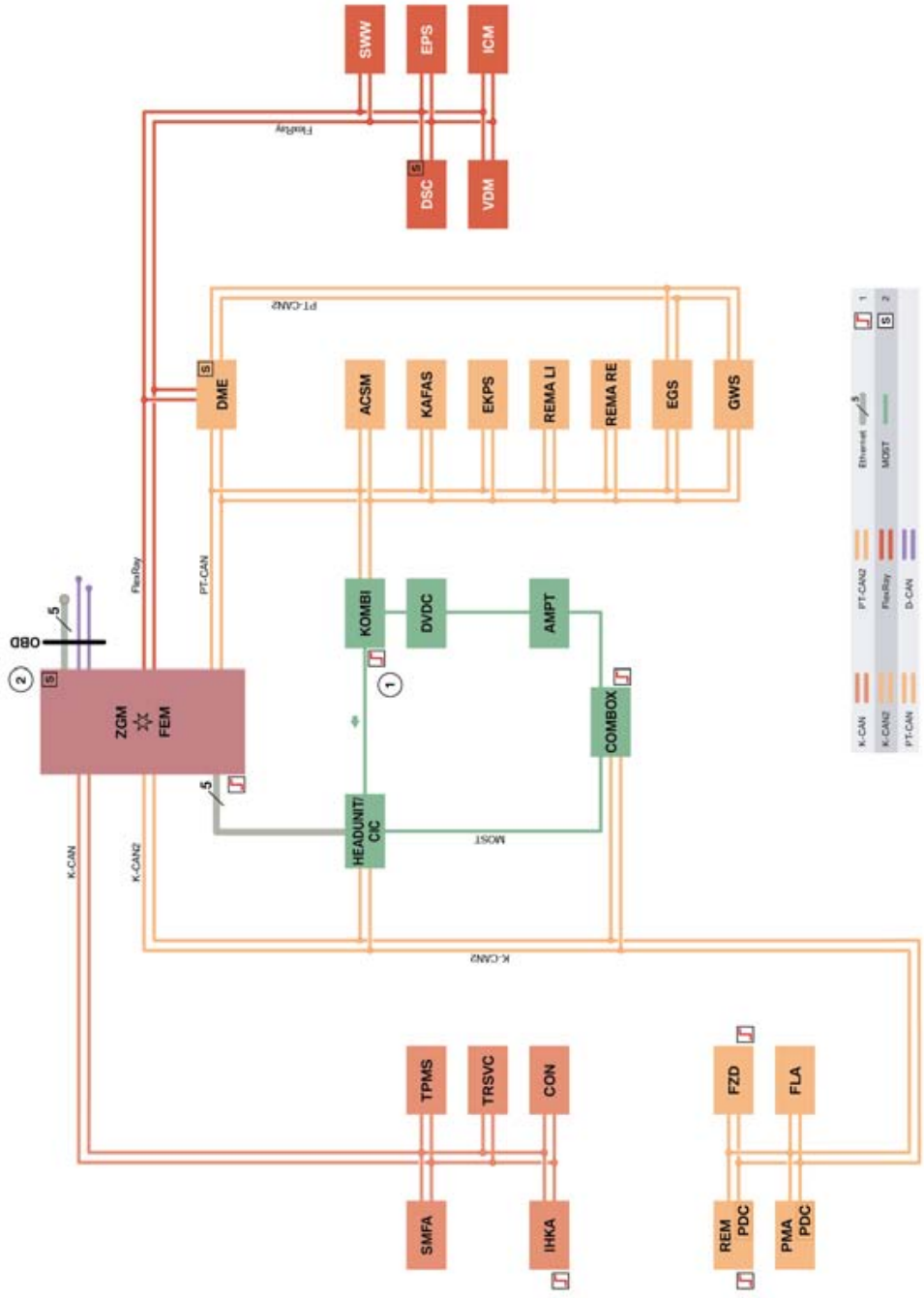
Index	Explanation
7	Parking brake
8	Wheels
9	Brakes
10	Two-joint spring strut front axle with trailing links

The chassis and suspension of the F30 is a further development based on the E90. The front axle is designed as a double pivot spring strut axle. A further improved version of the five-link rear axle HA5 is used on the rear axle. The chassis and suspension system takes driving dynamics and comfort to a new level.

F30 Chassis Dynamics

1. Introduction

1.3. Bus overview



F30 bus overview

F30 Chassis Dynamics

1. Introduction

Index	Explanation
1	Control units with wake-up authorization
2	Start-up node control units for starting and synchronizing the FlexRay bus system
ACSM	Advanced Crash Safety Module
AMPT	Top-HiFi amplifier
COMBOX	Combox (Combox emergency call, Multimedia Combox)
CON	Controller
D-CAN	Diagnosis-on-Controller Area Network
DME	Digital Engine Electronics (DME)
DSC	Dynamic Stability Control
DVDC	DVD changer
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EPS	Electromechanical Power Steering
Ethernet	Cable-based data network technology for local data networks
FEM	Front Electronic Module
FLA	High-beam assistant
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive sector
FZD	Roof function center
GWS	Gear selector lever
HEADUNIT/CIC	Headunit (Car Information Computer or Basic headunit)
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air conditioning
K-CAN	Body controller area network
K-CAN2	Body controller area network 2
KAFAS	Camera-based driver assistance systems
KOMBI	Instrument cluster (MOST only with option 6WA)
MOST	Media Oriented System Transport
OBD	On-board diagnosis (diagnostic socket)
PDC	Park Distance Control (with option 5DP, parking manoeuvring assistant: integrated in the parking manoeuvring assistant control unit, otherwise integrated in the Rear Electronic Module control unit)
PMA	Parking manoeuvring assistant
PT-CAN	Powertrain controller area network
PT-CAN2	Powertrain controller area network 2
RAD	Radio

F30 Chassis Dynamics

1. Introduction

Index	Explanation
REM	Rear Electronic Module
REMA LI	Reversible electromotive automatic reel, left (not US)
REMA RE	Reversible electromotive automatic reel, right (not US)
SMFA	Seat module, driver
SWW	Lane change warning
TPMS	Tire Pressure Monitoring System
TRSVC	Control unit for all-round vision camera
VDM	Vertical Dynamics Management
ZGM	Central gateway module

The FlexRay is shown in a simplified form in the overview of the bus systems. The information bulletin "F30 General vehicle electrical system" contains the actual physical configuration (topology).

F30 Chassis Dynamics

2. Models

2.1. Comparison

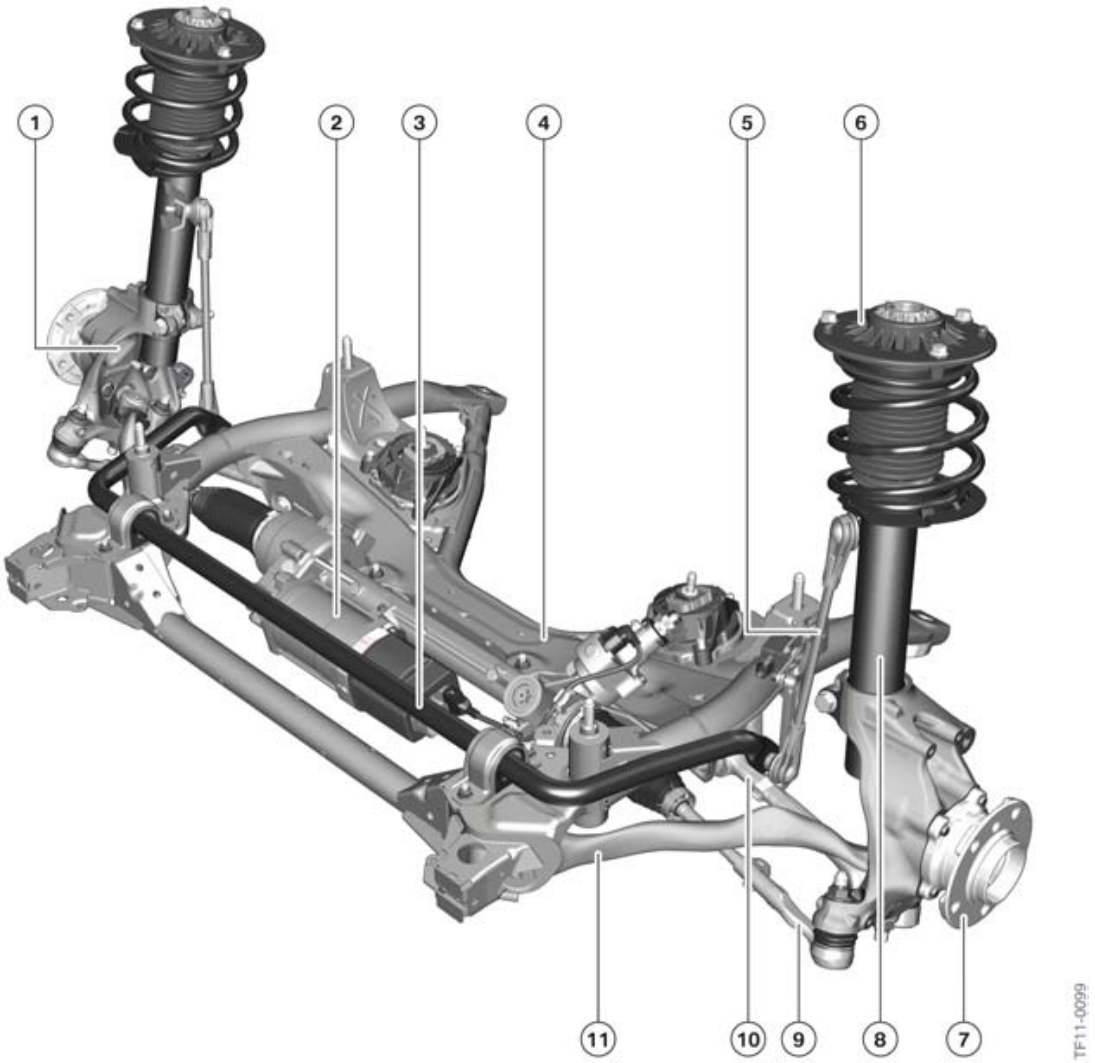
The following table compares the technical data of the chassis and suspension in the F30 with its predecessor E90 using the example of the BMW 328i model.

Designation	F30 328i	E90 328i model
Wheelbase	2810 mm	2761 mm
Front track width	1531 mm	1501 mm
Rear track width	1572 mm	1529 mm
Tires, basic wheels	225/50 R17 AS	205/55 R16 91V
Basic wheel rims	7.5J x 17 LM	7J x 16 l
Front axle	Two-joint spring strut front axle with trailing links	Two-joint spring strut front axle with trailing links
Springs/dampers	Steel spring/conventional or EDC	Steel springs, conventional
Anti-roll bar, front	mechanical	mechanical
Front brake	Brake disc, ventilated	Brake disc, ventilated
Steering	EPS rack	Hydraulic
Rear axle	Five-link rear suspension	Five-link rear suspension
Rear suspension/dampers	Steel spring/conventional or EDC	Steel springs, conventional
Rear anti-roll bar	Mechanical	mechanical
Rear brakes	Brake disc, ventilated	Brake disc, ventilated
Parking brake	Duo-servo parking brake with parking brake lever	Duo-servo parking brake with parking brake lever

F30 Chassis Dynamics

3. Chassis and Suspension

3.1. Front axle



Two-joint spring strut front axle with trailing links in F30

Index	Explanation
1	Swivel bearing
2	Electronic Power Steering EPS
3	Anti-roll bar
4	Front axle support
5	Anti-roll bar link
6	Support bearing

F30 Chassis Dynamics

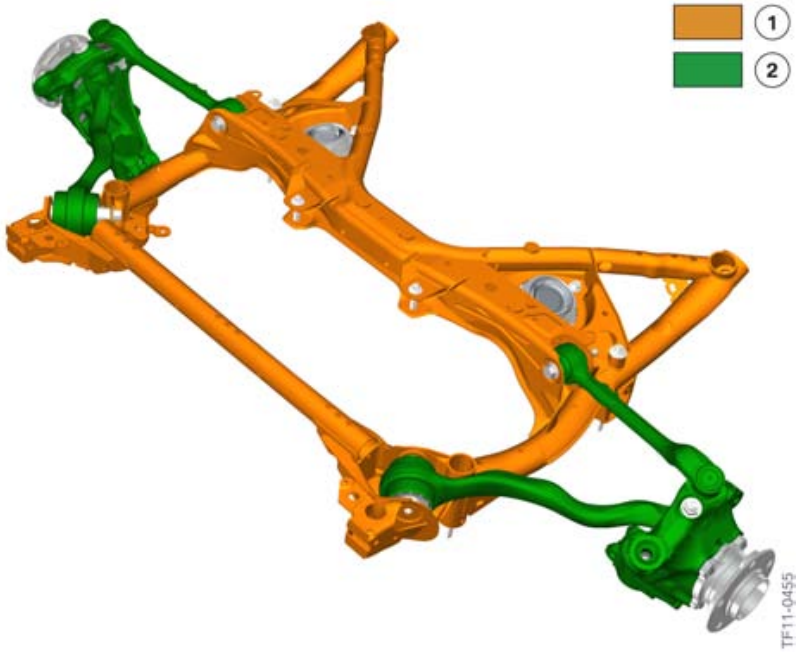
3. Chassis and Suspension

Index	Explanation
7	Wheel hub
8	Spring strut
9	Track rod
10	Wishbone
11	Trailing link

The two-joint spring strut front axle with trailing links in the F30 represents the optimum combination of driving dynamics and ride comfort. The load-bearing function of the steering box housing achieves an extremely high degree of rigidity with the lowest possible weight.

Compared to its predecessor in the E90, the front axle support in the F30 must satisfy more stringent requirements. A second crash load path has now been integrated above the front axle support. In order to guarantee optimum crash behavior, a high-strength welded steel structure has been used instead of an aluminium front axle support.

Improved acoustic properties and maximum rigidity and accompanying increase in ride comfort can be achieved with a small installation space.



Front axle of F30 - viewed from below

Index	Explanation
1	High-strength steel
2	Aluminium

F30 Chassis Dynamics
3. Chassis and Suspension

The ball joints of the front axle have been friction-optimized. This has made it possible to improve the response characteristics.

Use of cast aluminium parts (wishbones, trailing links) and aluminium die-cast parts (swivel bearings) reduces the unsprung masses.

The Electronic Power Steering EPS (electromechanical power steering) that features in the F30 makes an important contribution to BMW EfficientDynamics.

For vehicles with an adaptive M sports suspension (optional equipment 2VF) the electronic damper control EDC is also integrated.

3.1.1. Technical data

Designation	Without optional equipment 2VF Adaptive M Suspension or optional equipment 704 Sport Suspension	With optional equipment 2VF Adaptive M Suspension or optional equipment 704 Sport Suspension
Castor angle	7.0°	7.2°
Camber	–20'	–29'
Total toe-in	14'	14'
Toe difference angle at 20°	86'	86'
Maximum wheel lock angle, outer	33.8°	33.4°
Maximum wheel lock angle, inner	40.5°	40.0°

Please refer to the latest Technical Data for alignment specs.

For servicing a camber correction is possible by means of a disconnected swivel bearing available in the spare parts service.

Two versions of this swivel bearing are available:

- Version 1: Camber correction –0° 30'
- Version 2: camber correction 0° 30'.

F30 Chassis Dynamics

3. Chassis and Suspension

3.1.2. Notes for service

The following tables show when front wheel alignment is necessary.

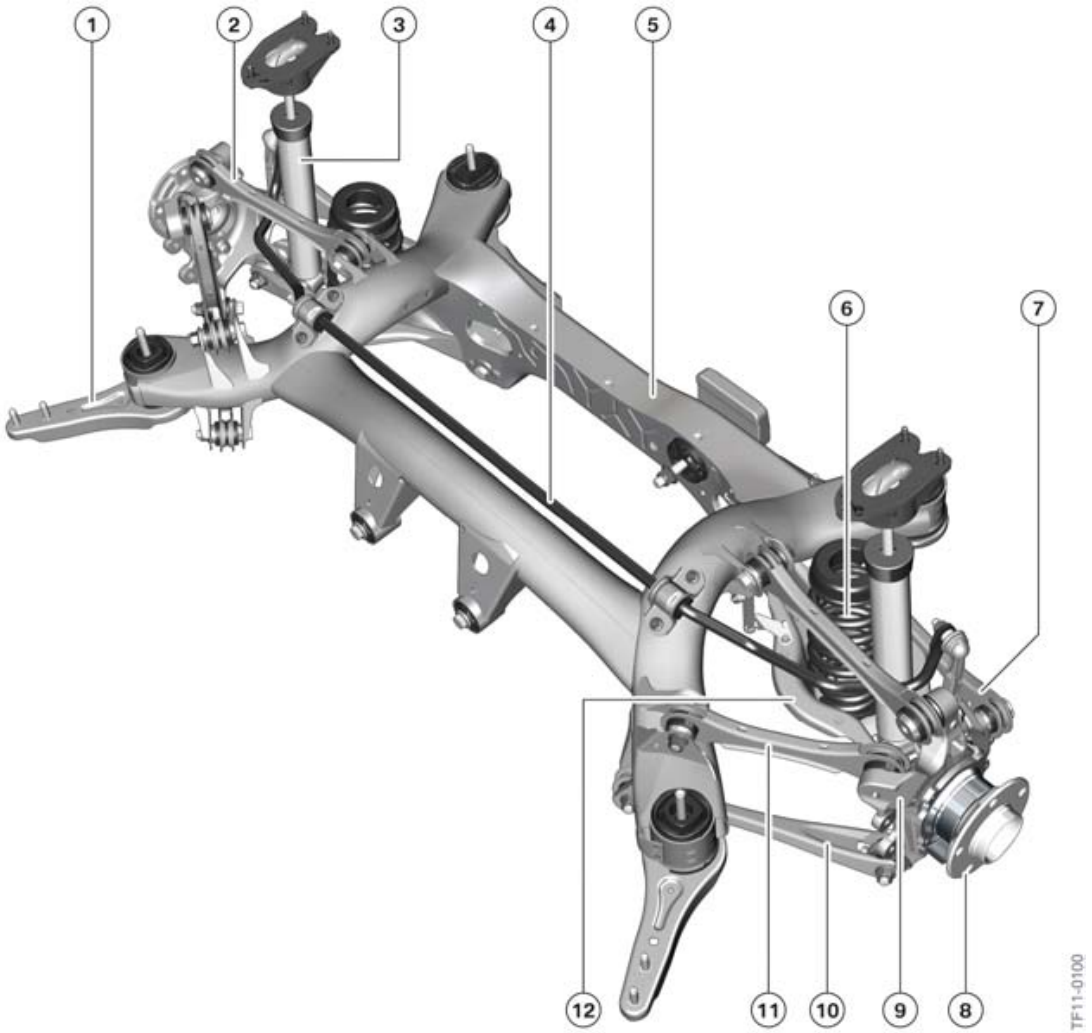
Component replaced	Wheel alignment required
Front axle support	YES
Steering box	YES
Wishbone	YES
Rubber mount for wishbone	YES
Trailing link	NO
Rubber mount for trailing link	NO
Track rod	YES
Swivel bearing	YES
Wheel bearing	NO
Spring strut	NO
Coil spring	NO
Support bearing	NO

Screw connection unfastened	Wheel alignment required
Front axle support to body	NO
Steering box to front axle support	YES
Wishbone to front axle support	YES
Wishbone to swivel bearing	NO
Trailing link to front axle support	NO
Trailing link to swivel bearing	NO
Track rod to steering box	NO
Track rod end to track rod	YES
Track rod end to swivel bearing	NO
Spring strut to swivel bearing	NO
Support bearing to body	NO
Steering shaft to steering gear	NO
Steering column to steering shaft	NO

F30 Chassis Dynamics

3. Chassis and Suspension

3.2. Rear axle



F30 Five-link rear suspension

Index	Explanation
1	Compression strut
2	Wishbone
3	Damping action
4	Anti-roll bar
5	Rear axle support
6	Suspension
7	Camber link

F30 Chassis Dynamics

3. Chassis and Suspension

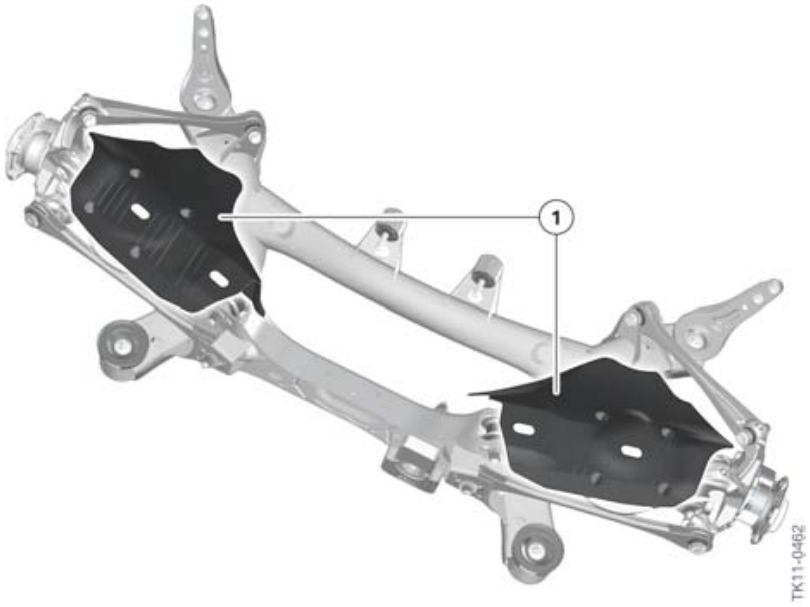
Index	Explanation
8	Wheel hub
9	Wheel carrier
10	Trailing arm
11	Control arm
12	Camber link

In the F30 a five-link rear axle has been used. HA5 This is based on the predecessor but has undergone significant further development and has been implemented as a steel construction.

Elasto-kinematics are installed in the five-link rear axle, which are coordinated specifically to the F30. The precise and superior wheel control in all driving situations has a large spring travel range.

It has been possible to resolve the conflicting objectives of driving dynamics and comfort by:

- A flexible suspension of rear axle differential at rear axle support and a flexible bearing of rear axle support at body (2x flexible bearing), which have been specifically coordinated to the F30
- Maximum support base width for the rear axle support
- Significant increase in track width when compared to E90
- Optimum connection of body suspension and damping.



F30 aerodynamic covers

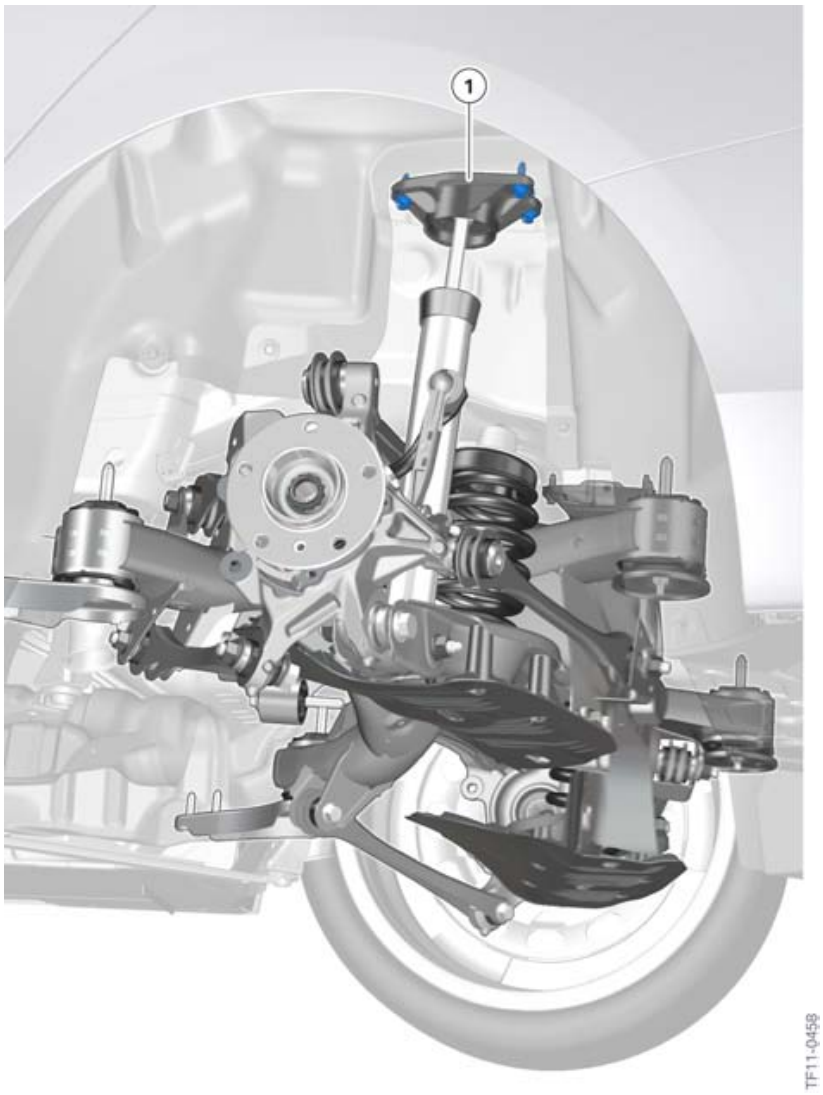
Index	Explanation
1	Aerodynamic covers

F30 Chassis Dynamics

3. Chassis and Suspension

Specific aerodynamic measures improve the lift coefficients and the drag coefficient (Cd), which has a positive impact on consumption and driving dynamics. Thus aerodynamic covers made of fibre-glass-reinforced polyamide has been fitted to the camber links of the F30.

When compared to the E90 , it has been possible to increase the loading width of the luggage compartment and leg room in the rear passenger compartment.



F30 shock absorber, rear axle

Index	Explanation
1	Support bearing with multiple load path

F30 Chassis Dynamics

3. Chassis and Suspension

The shock absorber design of the F30 and E90 are different. In the F30, firstly the pivot point of the shock absorber to the camber link was modified, and secondly no more work is necessary in the luggage compartment for dismantling the shock absorber.

The support bearing with single load path for the shock absorber in the E90 is screwed to the body from the inside. The support bearing in the F30 is a multiple-path version and is fastened to the body from the outside.

3.2.1. Technical data

Designation	Without optional equipment 2VF or optional equipment 704	With optional equipment 2VF or optional equipment 704
Total toe-in	18'	18'
Camber	–90'	–105'

Please refer to the latest Technical Data for alignment specs.

3.2.2. Notes for Service

The following tables show when rear wheel alignment is necessary.

Component replaced	Wheel alignment required
Rear axle support	YES
Rubber mount for rear axle support	NO
Wheel carrier	YES
Ball joint and rubber mount in wheel carrier	YES
Control arm	NO
Trailing arm	NO
Wishbone	YES
Camber link	YES
Camber link	YES
Wheel bearing	NO
Shock absorber	NO
Coil spring	NO
Support bearing	NO

Screw connection unfastened	Wheel alignment required
Rear axle support to body	NO
Compression strut to body	NO
Control arm to rear suspension subframe	NO
Control arm to hub carrier	NO

Screw connection unfastened	Wheel alignment required
Trailing arm to rear axle support	NO
Trailing arm to wheel carrier	NO
Wishbone to rear axle support	YES
Wishbone to wheel carrier	NO
Camber link to rear axle support	YES
Camber link to wheel carrier	YES
Camber link to rear axle support	YES
Camber link to wheel carrier	YES
Support bearing to body	NO

3.3. Suspension/dampers

3.3.1. Basic chassis and suspension

Steel springs are mounted to the front and rear axle of the F30.

Damping is provided by conventional shock absorbers as standard. Spring struts are installed at the front axle and springs and dampers are arranged separately at the rear axle.

3.3.2. M Sports suspension

Vehicles with M Sports suspension (optional equipment 704) have a tighter spring/damper design and are positioned 10 mm lower.

3.3.3. Adaptive M chassis and suspension

Vehicles with an adaptive M sports suspension (optional equipment 2VF) are also positioned 10 mm lower.

In addition, the electronic damper control EDC is integrated. Here four continuously adjustable shock absorbers with coupled rebound/compression stage adjustment produce damping forces according to requirements. The shock absorbers can automatically assume a harder setting (more dynamic/sporty) or softer (more comfortable) setting, depending on the driving manoeuvre.

For more information on the EDC refer to Chapter "Electronic Damper Control (EDC)".

F30 Chassis Dynamics

3. Chassis and Suspension

3.4. Wheels and Tires

The standard Tire sizes are listed in the following tables.

Model	Tires	Wheel rim	Rim offset IS
BMW 328i	225/50 R17 94V AS	7.5J x 17 LA	37 mm
BMW 335i	225/45 R18 91V AS	8J x 18 LA	34 mm

Run-flat tires on the F30 are standard equipment.

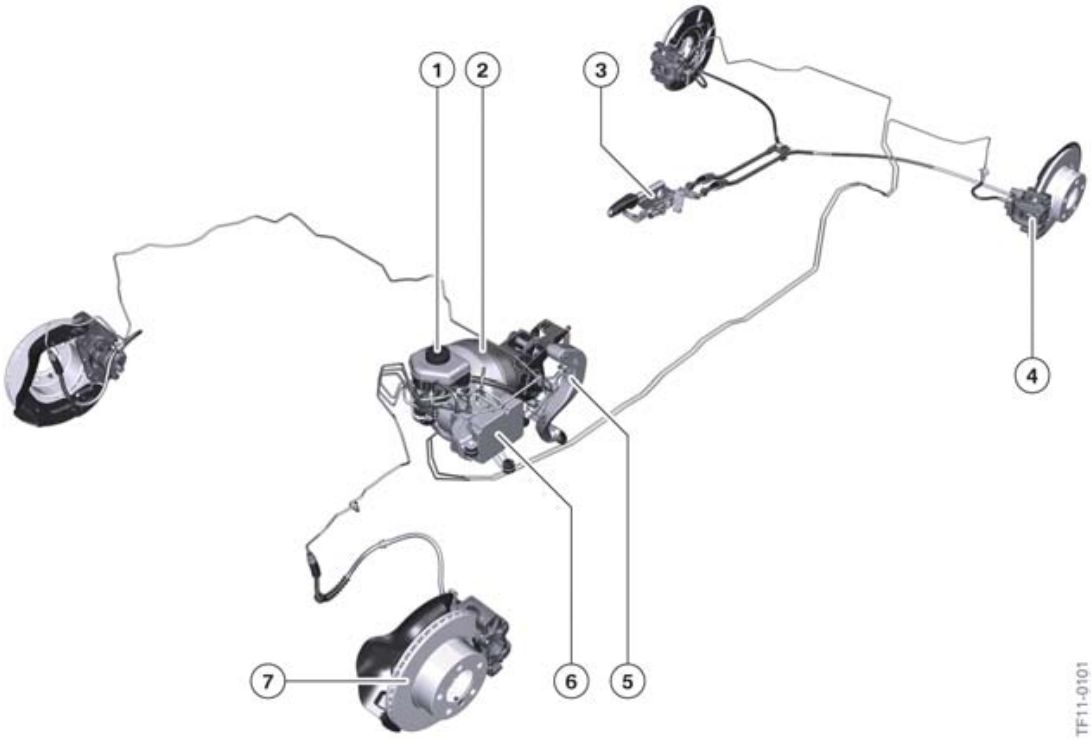
3.4.1. Tire Pressure Monitor TPMS

The F30 is equipped with the latest generation of the TPMS (Tire pressure control).

For further information on the TPMS, please refer to the Training Material "F25 Chassis and Suspension".

F30 Chassis Dynamics

4. Brakes



F30 Brake system

Index	Explanation
1	Brake fluid expansion tank
2	Brake servo
3	Parking brake
4	Brake caliper
5	Brake pedal
6	Dynamic Stability Control DSC
7	Brake disc

4.1. Service brakes

The F30 features a hydraulic 2-circuit brake system with “front/rear split”. One brake circuit is intended for both the front and rear axle.

The familiar brake pad wear monitoring function for the Condition Based Service display continues to be used. Single-stage brake pad wear sensors are installed on the front left and rear right wheel brakes for this purpose.

F30 Chassis Dynamics

4. Brakes

F30 level sensor for brake fluid

The brake fluid level sensor in the F30 is no longer integrated into the lid of the tank and is instead inserted into the tank itself.

The brake disc dimensions for the F30 are listed in the following table.

Model	Brake disc, front axle (Ø/thickness) [mm]	Brake disc, rear axle (Ø/thickness) [mm]
BMW 328i	330 x 24	300 x 20
BMW 335i	340 x 30	330 x 20

For all engine versions, internally ventilated, coated brake discs are used on both axles. In the BMW 335i lightweight brake discs with an aluminium brake disc chamber are installed as standard.

In the F30 twor brake caliper variants are used on the front axle and two on the rear axle depending on the model:

Brake caliper, front axle	Models
Single-piston floating caliper, piston Ø 57 mm, aluminium	BMW 328i
Four-piston fixed caliper, piston Ø 40 mm, aluminium	BMW 335i

Brake caliper, rear axle	Models
Single-piston floating caliper, piston Ø 42 mm, cast iron	BMW 328i
Single-piston floating caliper, piston Ø 42 mm, cast iron	BMW 335i

F30 Chassis Dynamics

4. Brakes

4.2. Parking brake

The parking brake is designed as a duo-servo parking brake with the following dimensions:

- 185 x 20 mm for BMW 328i and 335i.

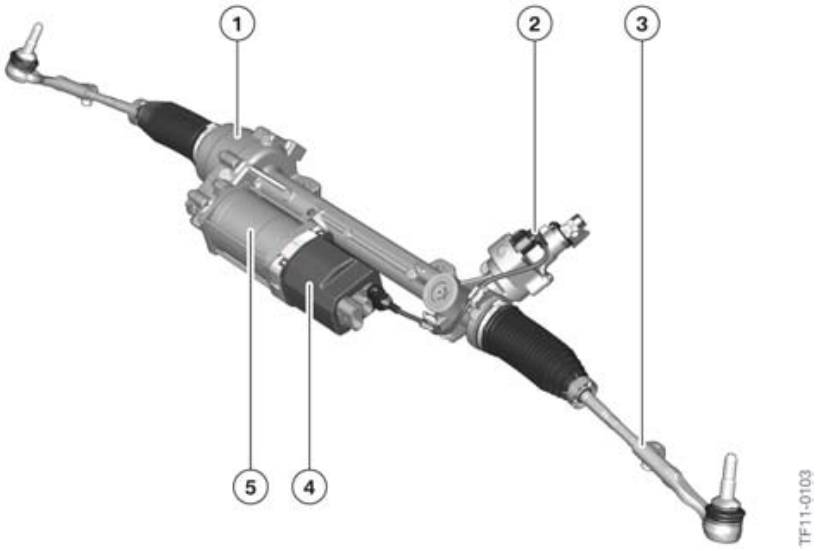
F30 Chassis Dynamics

5. Steering

5.1. Electronic Power Steering EPS

The F30 features Electronic Power Steering EPS (electromechanical power steering) which replaces the conventional hydraulic steering.

When compared to hydraulic steering, with EPS the power assist is applied to the rack via an electric motor and a reduction gear.



Steering gear of EPS in F30

Index	Explanation
1	Reduction gear
2	Steering-torque sensor
3	Track rod
4	EPS control unit
5	Electric motor with rotor position sensor

Thanks to the supply of condition-based power, the average fuel consumption has been reduced by approx. 3% compared to conventional hydraulic power steering. This helps reduce carbon dioxide emissions.

As there is no oil in an EPS system, it is more environmentally friendly and easier to service than a conventional hydraulic power steering system.

Owing to the compact design of the steering gear with integrated electric motor and control electronics, the installation and maintenance overheads are considerably less than a conventional hydraulic power steering system.

With EPS, both the steering servo (steering force) and return can be freely balanced. Steerability and drivability can therefore be adapted optimally to the relevant driving situation (e.g. when driving in built-up areas or on the highway).

F30 Chassis Dynamics

5. Steering

Servotronic is installed as standard equipment on the F30. The Servotronic controls the steering servo subject to the vehicle speed. Two different settings (“Normal” and “Sporty”) can be accessed via the driving experience switch.

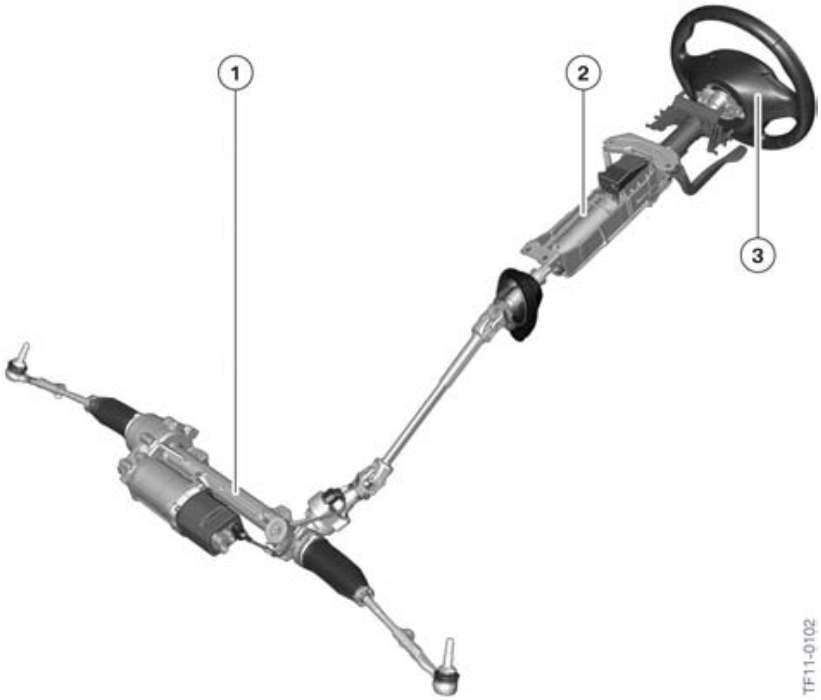
Active steering is not available for the F30, "Variable sports steering" (SA 2VL) is instead available as optional equipment.

The EPS a prerequisite for implementation of the Parking Manoeuvring Assistant PMA.

Depending on the F30 options two variants of steering gear are used:

- EPS basic steering gear for BMW 328i and 335i.
  With this steering gear the housing and the mechanics are designed for higher axle loads. The electrical motor is enhanced and the engine shortened.
  Manufacturer: ThyssenKrupp.
- EPS for variable sport steering (optional equipment 2VL).
  In terms of the housing, this steering gear corresponds to the mechanics and the engine of the EPS for BMW 328i and 335i. However, the electric motor is designed for the higher dynamics of sport steering. In addition, a rack with variable ratio is installed.
  Manufacturer: ThyssenKrupp.

5.1.1. System overview



Steering components of EPS in F30

F30 Chassis Dynamics

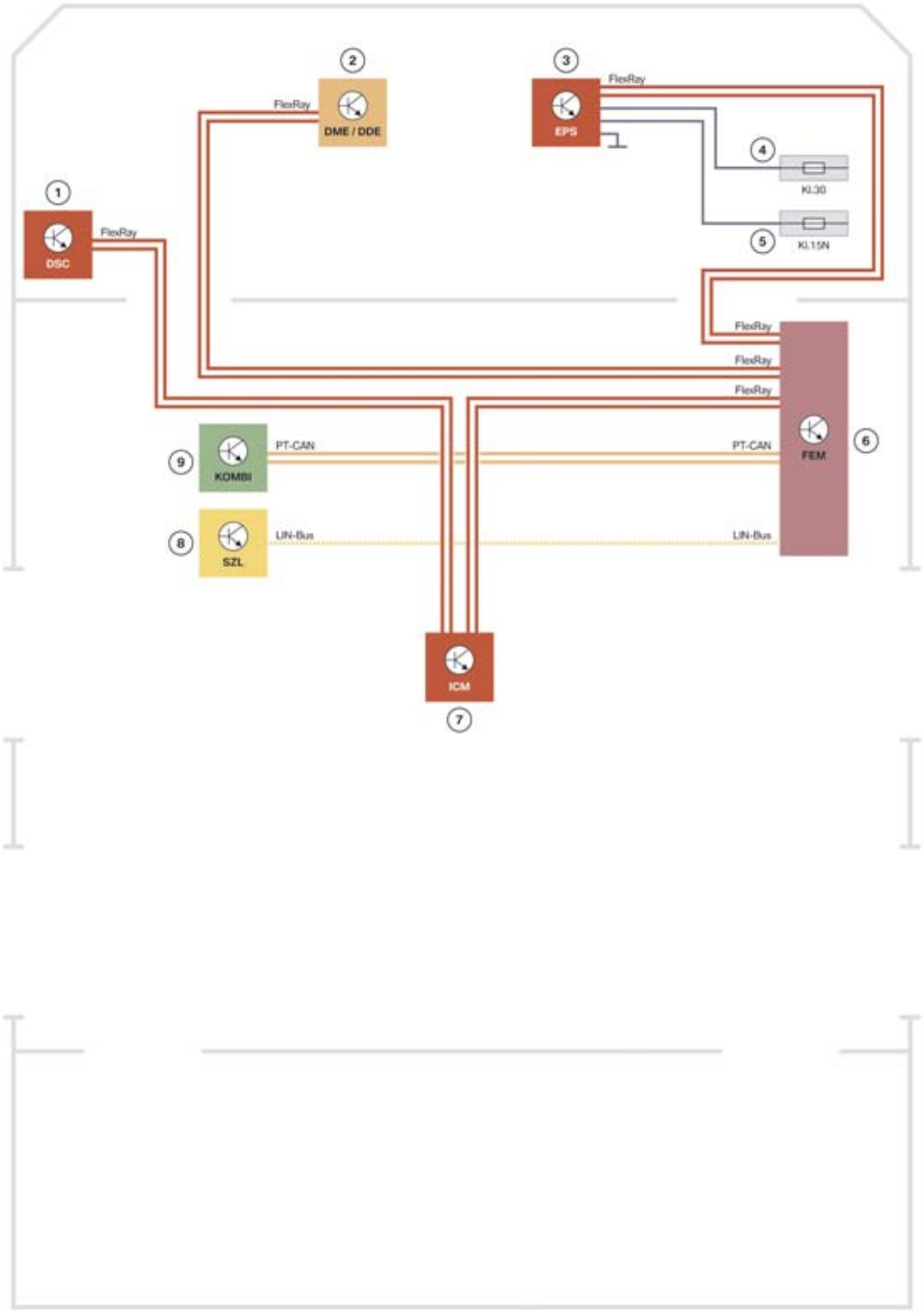
5. Steering

Index	Explanation
1	Electronic Power Steering EPS
2	Steering column
3	Steering wheel

F30 Chassis Dynamics

5. Steering

5.1.2. System wiring diagram



System wiring diagram of EPS in F30

Index	Explanation
1	Dynamic Stability Control DSC
2	Digital Engine Electronics (DME) or Digital Diesel Electronics (DDE) (not US)
3	Electronic Power Steering EPS
4	Power distribution box, front
5	Power distribution box, engine compartment
6	Front Electronic Module (FEM)
7	Integrated Chassis Management (ICM)
8	Steering column switch cluster (SZL)
9	Instrument cluster (KOMBI)
KI.15N	Ignition (after-run)
Terminal 30	Terminal 30

5.1.3. Steering angle sensor

The information on the steering angle in the F30 is not recorded by the Electronic Power Steering EPS via a separate sensor on the steering wheel and instead is computed based on the angle of the EPS motor position in relation to the steering wheel.

The EPS transmits the position of the rack to the ICM control unit via FlexRay. During this process, the EPS calculates the absolute position of the rack based on the current rotor position of the EPS motor and the number of complete revolutions performed by the rotor starting from the zero position (straight-ahead driving position).

Taking this position as the starting point, the ICM control unit determines the wheel-specific steering angle among other things using the stored ratio parameters (rack to wheel-specific steering angle) and transmits this via FlexRay. This wheel-specific steering angle is used by the DSC among other things as a reference variable for internal control functions.

In cases where the absolute value is not available from the EPS (loss of Terminal 30, flash process), the absolute value is determined through interaction between the ICM and EPS using a teaching function in which the steering wheel is turned from end stop to end stop (e.g. straight-ahead position -> left -> right -> straight-ahead position).

5.2. Variable sport steering

The "Variable sport steering" (optional equipment 2VL) is available for the F30 as an alternative to the basic version of EPS. This is the first steering system on the market to combine the benefits of an extremely direct, variable steering gear ratio and the operating principle of EPS.

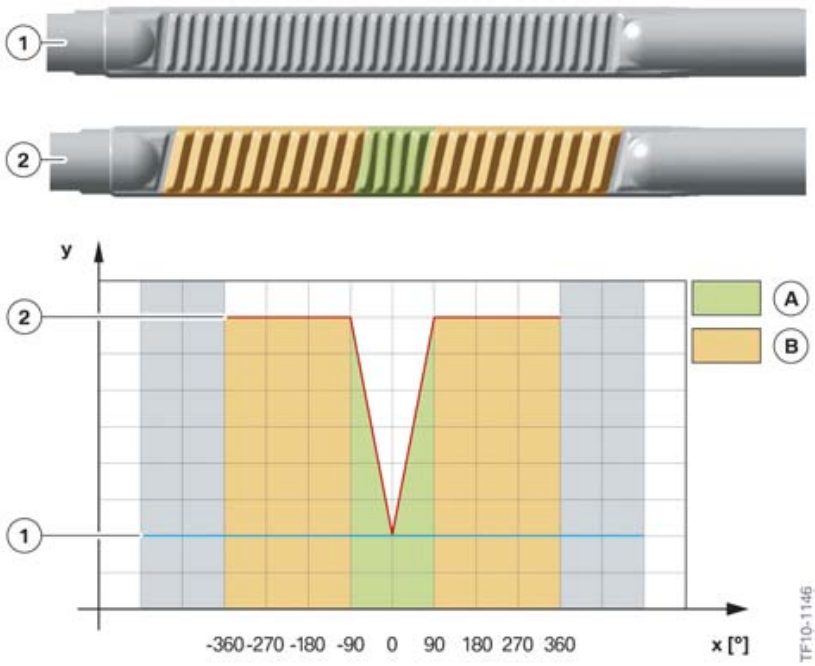
The variable sport steering increases both ride comfort and agility. The direct ratio reduces the overall steering angle, i.e. the number of turns of the steering wheel required to turn from one steering stop to the other, by roughly 25%. This therefore helps manoeuvres that require a larger steering angle, e.g. parking, turning off or turning round, to be carried out more comfortably.

F30 Chassis Dynamics

5. Steering

The more direct steering gear ratio when compared to the basic version of the EPS and the reduced steering angle which is required as a result achieves a more direct vehicle response and higher agility. This comes in handy during avoidance manoeuvres for example.

The variable steering gear ratio is implemented through the stroke-dependent gear geometry of the rack. Around the center position of the steering gear, the steering system behaves accurately with steady directional stability. As the steering angle moves away from the center position, the ratio becomes increasingly more direct.



Comparison between steering gear ratio of basic EPS version and variable sport steering for F30

Index	Explanation
1	Rack in basic version of EPS (constant gear geometry)
2	Variable sport steering rack (variable gear geometry)
A	More indirect steering gear ratio (variable sport steering)
B	More direct steering gear ratio (variable sport steering)
x	Steering angle
y	Rack stroke

F30 Chassis Dynamics

5. Steering

5.3. Steering column

Thanks to an integrated crash system, in the event of an accident the steering column can dissipate additional energy through specific deformation.

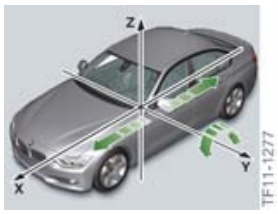
5.3.1. Steering column adjustment

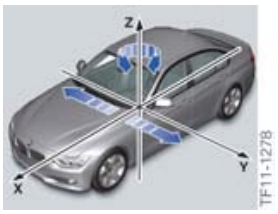
The steering column of the F30 can be adjusted mechanically; a forward/back adjustment of 60 mm and height adjustment of 40 mm is possible. This allows optimum ergonomic positioning of the driver.

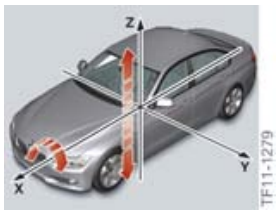
F30 Chassis Dynamics

6. Driving Stability Control

6.1. Directions of action







Direction of action	Longi-tudinal	Pitch	Lateral	Yaw	Vertical	Roll
DSC	●		●	●		●
EDC	●	●	●		●	●
DCC	●					

Driving stability control systems can be differentiated in terms of their basic effective directions. They can act along as well as around an axis of the vehicle's fixed X, Y or Z coordinate system.

6.2. Integrated Chassis Management (ICM)

6.2.1. System overview

F30 ICM control unit

Index	Explanation
1	ICM control unit

6.2.2. System function

The Integrated Chassis Management ICM coordinates, as monitoring system so to speak, all driving stability control systems and vehicle control systems. The advantage of this structure is that the individual systems can continue processing their immediate functions rapidly and also independently. As the higher-level central control system, the ICM monitors and coordinates interventions and sends instructions to intelligent actuators. This allows braking, steering or torque interventions to be performed, for example.

Influence of ICM control unit on driving stability control

- **Driving dynamics control FDR**
  The driver can activate and deactivate the driving dynamics control (FDR) via the DTC button or the driving experience switch. The function mode is displayed in the instrument cluster KOMBI.
  The ICM control unit evaluates the DTC button and driving experience switch as well as the switching logic, as well as communication between the various systems involved (including DSC). Furthermore, the ICM control unit includes system monitoring of partner functions which switches back to normal mode (DSC ON) if one of the functions being monitored drops out.
- **Dynamic Cruise Control DCC**
  Dynamic Cruise Control DCC is a road speed controller with braking intervention. The DCC function in the ICM control unit acts on the powertrain and brake via corresponding interfaces. In addition, interfaces exist with display and operating elements and the driving dynamics sensor systems.
  Further information on the DCC can be found in the chapter entitled "Dynamic Cruise Control DCC".
- **Active cruise control with Stop&Go function (optional equipment 5DF) Not at start of production.**
  The active cruise control with Stop&Go function (ACC Stop & Go) is a speed regulator with a distance regulator function. The "ACC Stop & Go" function in the ICM control unit acts on the powertrain and brake via corresponding interfaces. In addition, interfaces exist with display and operating elements and the driving dynamics sensor systems.

Sensor system

As the central element, the ICM control unit incorporates the driving dynamics sensors and central airbag sensor system. It is installed near the vehicle's center of gravity via a holder on the center console.

Function	Vehicles without EDC	Vehicles with EDC
Longitudinal acceleration (airbag sensor system)	●	●
Lateral acceleration (airbag sensor system)	●	●
Longitudinal acceleration	●	●

F30 Chassis Dynamics
6. Driving Stability Control

Function	Vehicles without EDC	Vehicles with EDC
Lateral acceleration	●	●
Vertical acceleration	–	●
Yaw rate	–	●
Pitch rate	–	●
Yaw rate	●	●

The following signals are calculated from this and made available to the DSC via FlexRay:

- Yaw rate
- Lateral acceleration
- Longitudinal acceleration
- Steering angle.

6.3. Dynamic Stability Control DSC

The Dynamic Stability Control DSC forms the core of the vehicle control systems that enhance active safety. It optimizes driving stability in all driving conditions and also traction when driving off and accelerating. Furthermore, it identifies unstable driving conditions such as understeering or oversteering and helps maintain the vehicle on a steady course.

In the F30 two variants of the DSC are used. In the basic version the hydraulic unit has an internal pressure sensor and a double piston pump. For vehicles with active cruise control with Stop&Go function (optional equipment 5DF) “Not at start of production” a version with two additional pressure sensors is installed.

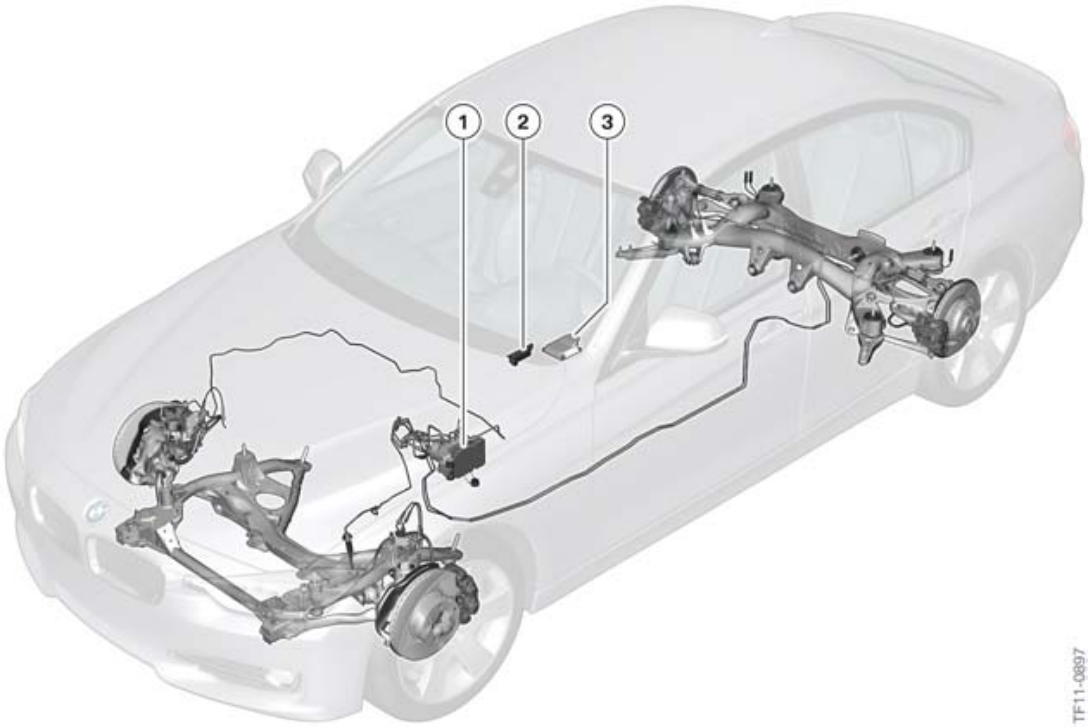
The ultra sensitive sensors of the F30 record the current driving condition permanently. The information comes for example from the wheel speed, steering angle, lateral acceleration, longitudinal acceleration, pressure and yaw sensors (detect rotation on the vehicle's vertical axis). The single-track model calculated by the DSC control unit serves as the basic variable for control interventions in the DSC. During this process, the relevant driver input (steering wheel angle and vehicle speed), in other words "the desired state", and the vehicle sensor data, in other words "the actual state", are compared.

If the calculated desired state and measured actual state do not correspond, stabilizing or traction-enhancing measures are introduced once defined tolerances have been exceeded. Driving stability can once again be ensured or a traction requirement can be implemented by selectively reducing or increasing the engine torque (with active engine drag torque control) or through wheel-specific brake intervention.

F30 Chassis Dynamics

6. Driving Stability Control

6.3.1. System overview



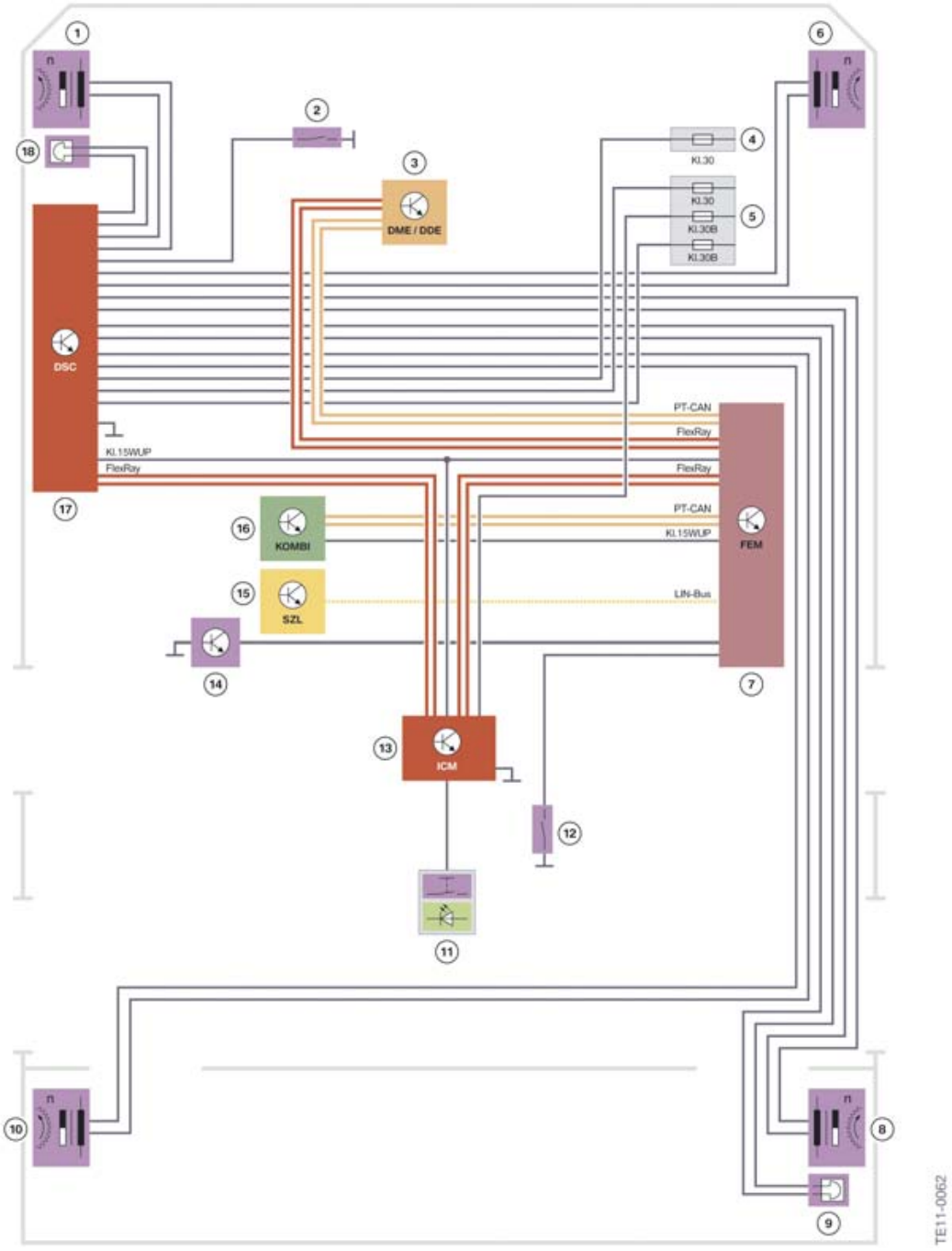
System overview of DSC in F30

Index	Explanation
1	Dynamic Stability Control (DSC)
2	Driving experience control button
3	Integrated Chassis Management (ICM)

F30 Chassis Dynamics

6. Driving Stability Control

6.3.2. System wiring diagram



System wiring diagram of DSC in F30

Index	Explanation
1	Wheel-speed sensor, front left
2	Brake fluid level switch
3	Digital Engine Electronics (DME) or Digital Diesel Electronics (DDE) (not US)
4	Power distribution box, engine compartment
5	Power distribution box, front
6	Wheel-speed sensor, front right
7	Front Electronic Module (FEM)
8	Wheel speed sensor, rear right
9	Brake pad wear sensor, rear right
10	Wheel speed sensor, rear left
11	Operating facility, center console
12	Parking brake switch
13	Integrated Chassis Management (ICM)
14	Brake light switch
15	Steering column switch cluster (SZL)
16	Instrument cluster (KOMBI)
17	Dynamic Stability Control (DSC)
18	Brake pad wear sensor, front right
Terminal 15WUP	Wake-up with terminal 15 ON
Terminal 30	Terminal 30
Terminal 30B	Terminal 30 basic operation

6.3.3. System function

Function	Subfunction	Designation
ABS		Antilock Brake System
	EBV	Electronic brake force distribution
	CBC	Cornering Brake Control
	DBC	Dynamic Brake Control
ASC		Automatic Stability Control
	ADB	Automatic Differential Brake (only active in DSC OFF mode)
	MMR	Engine torque control
	MSR	Engine drag control

F30 Chassis Dynamics

6. Driving Stability Control

Function	Subfunction	Designation
	BMR	Braking torque control
DSC		Dynamic Stability Control
	DTC	Dynamic Traction Control

The DSC can be operated in three modes:

- DSC ON
- Dynamic traction control, DTC
- DSC OFF.

F30 DTC button

Index	Explanation
1	DTC button

Function	DSC ON	DTC	DSC OFF
Anti-lock braking system ABS	●	●	●
Electronic brake-force distribution EBV	●	●	●
Cornering Brake Control CBC	●	●	●
Engine drag torque control MSR	●	●	●
Automatic Stability Control ASC	●	X	–

Function	DSC ON	DTC	DSC OFF
Automatic Differential Brake ADB	–	–	●
Driving dynamics control FDR	●	X	–
Brake standby	●	●	●
Dry by applying brake	●	●	●
Drive-off assistant	●	●	●
Fading Brake Support	●	●	●
Dynamic Braking Control DBC	●	●	●
Run Flat Indicator RPA	●	●	●
Condition Based Services CBS	●	●	●
Post Crash	●	●	●

Symbol	Explanation
●	Function active
–	Function inactive
X	Function with modified control thresholds

Adopting a suitably adapted driving style always remains the responsibility of the driver.

Not even DSC can overcome the laws of physics.

The additional safety features afforded by the system should not be diminished by risky driving.

6.4. Dynamic Cruise Control DCC

Dynamic Cruise Control DCC is a cruise control with comfortable brake intervention. DCC keeps the chosen speed constant above speeds of roughly 30 km/h - when compared to conventional cruise control with the following additional functions:

- **Active brake intervention** - if the engine drag torque is insufficient in coasting (overrun) mode to maintain the chosen speed, the vehicle is decelerated automatically through additional controlled brake intervention.

- **Curve Speed Limiter (CSL)** - Depending on the actual lateral acceleration, the driving speed is reduced during controlled cornering as necessary. When coming out of the bend the speed is adjusted until it once again reaches the desired level.

- **Comfort Dynamic System (CDS)** - Referred to as "Hand-controlled acceleration mode", this feature allows the driver to accelerate or decelerate continuously via an operating element on the steering wheel in two dynamic stages respectively. The driver can thus accelerate or decelerate in the traffic flow without having to estimate the target speed beforehand.
- **Adapted downhill driving** – Maintaining the desired speed during controlled downhill driving is effected by overrun fuel cutoff and adapted gear downshifting. The wheel brakes are relieved and the fuel consumption reduced. With the DSC braking control system, corresponding measures are applied via a substitute temperature model to compensate for leaks and distribute torque between the front and rear axle. This means that any leaks that occur in the braking control circuit can be counteracted.

The desired/resume speed is indicated in the instrument cluster KOMBI by a mark that moves round the speed reading. Depending on the system status the marking illuminates in green (active) or orange (system interrupted).

If the desired speed is adjusted, or when the DCC function is activated, the updated digital value appears briefly in the display as acknowledgement for the driver.

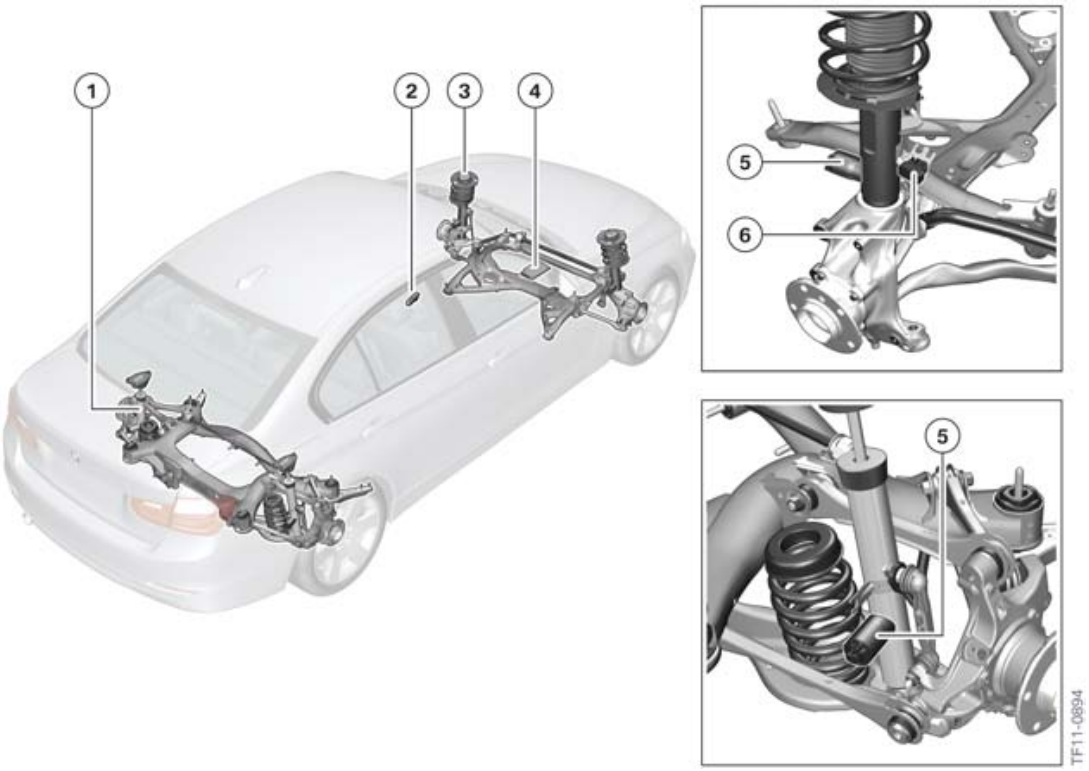
6.5. Electronic Damper Control (EDC)

For vehicles with an adaptive M sports suspension (optional equipment 2VF) the electronic damper control EDC is used. Here four continuously adjustable shock absorbers with coupled rebound/compression stage adjustment produce damping forces according to requirements. The shock absorbers can automatically assume a harder setting (more dynamic/sporty) or softer (more comfortable) setting, depending on the driving manoeuvre.

F30 Chassis Dynamics

6. Driving Stability Control

6.5.1. System overview



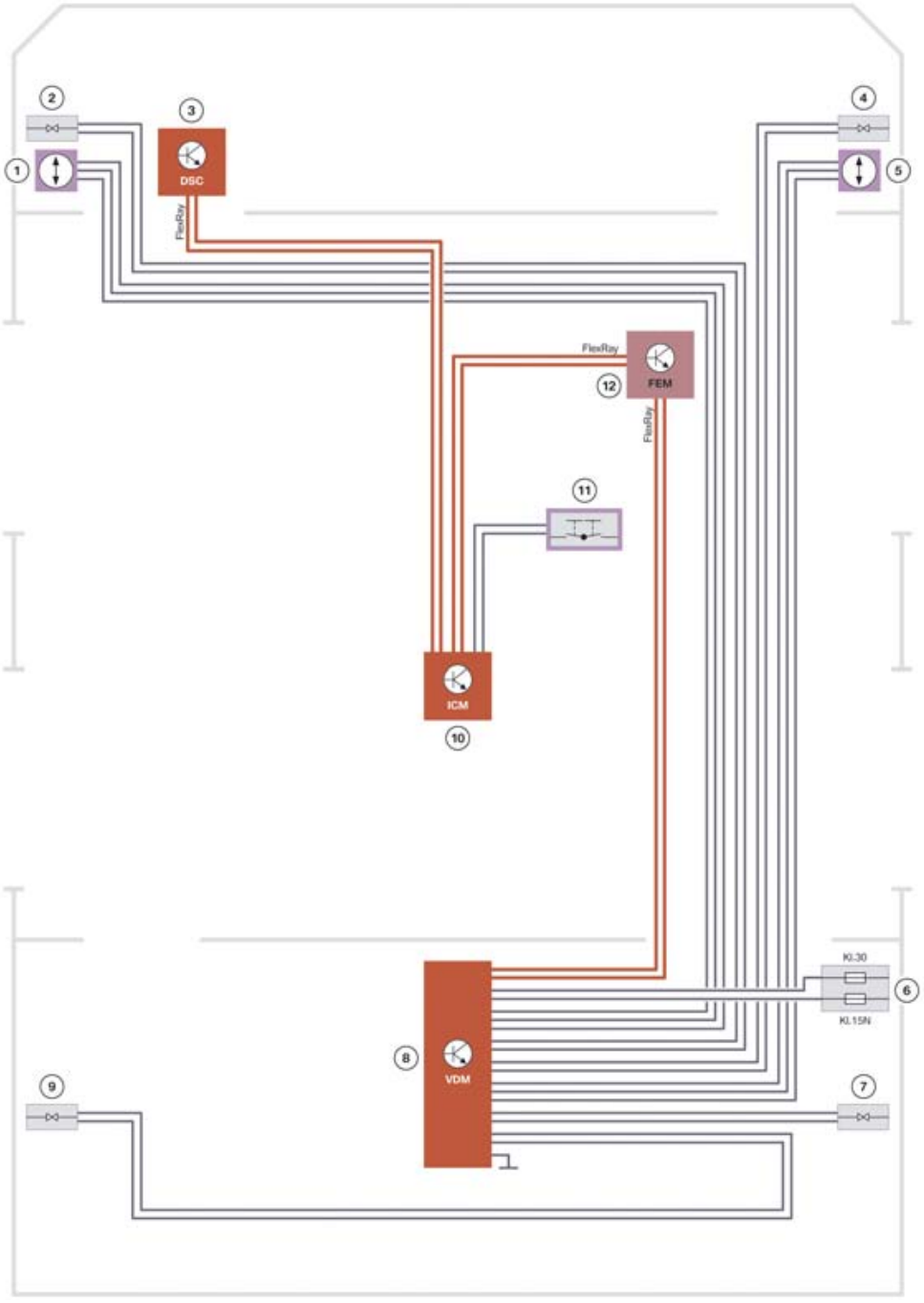
System overview of EDC in F30

Index	Explanation
1	Electronic adjustable damper, rear
2	Driving experience control button
3	Electronic adjustable damper, front
4	VDM control unit
5	Electromagnetic adjusting valve
6	Wheel acceleration sensor

F30 Chassis Dynamics

6. Driving Stability Control

6.5.2. System wiring diagram



System wiring diagram of EDC in F30

Index	Explanation
1	Vertical wheel acceleration sensor, front left
2	Electromagnetic adjusting valve, front left
3	Dynamic Stability Control DSC
4	Electromagnetic adjusting valve, front right
5	Vertical wheel acceleration sensor, front right
6	Power distribution box, luggage compartment
7	Electromagnetic adjusting valve, rear right
8	Vertical Dynamics Management (VDM)
9	Electromagnetic adjusting valve, rear left
10	Integrated Chassis Management (ICM)
11	Driving experience control button
12	Front Electronic Module (FEM)
Terminal 30	Terminal 30
Terminal 15N	Ignition (after-run)

6.5.3. System function

The Electronic Damper Control EDC is a variable, electronically controlled shock absorber adjustment system that controls the vertical dynamics. The EDC adapts the damping forces of the shock absorber more or less instantly to the changing road or driving conditions.

The Electronic Damper Control (EDC) comes with the optional equipment SA 2VF "Adaptive M sports suspension".

The EDC consists of:

- Four continuously adjustable shock absorbers with coupled rebound/compression stage adjustment
- The VDM control unit
- Two wheel acceleration sensors on the front axle to determine the wheel movement
- Sensor cluster integrated into the ICM control unit which determines the body movements (pitch, vertical, roll).

The sensors in the vehicle permanently measure:

- The body and wheel acceleration
- The current lateral and longitudinal acceleration
- The vehicle speed
- The steering wheel position.

F30 Chassis Dynamics
6. Driving Stability Control

Based on this measured data, the VDM control unit calculates the control commands to be sent to the electromagnetic valves in the shock absorbers for each individual wheel according to the road profile and driving situation. This means that the damping forces will always be applied according to requirements.

This improves ride comfort and also increases driving dynamics.

This improves the vehicle's:

- Suitability for long-distance journeys
- Enhanced body stability and agility
- Improves driving safety by minimizing wheel load fluctuations and reducing the stopping distance.

The driver can choose between the more comfortable or more sporty aspect of the vehicle's character via the driving experience switch.

6.5.4. Notes for Service

Separate lines are still used between the dampers, including the sensors at the front axle and wiring harness. These are not shown in the system wiring diagram and can be replaced individually when carrying out repairs.

6.6. Driving experience control button

F30 driving experience control button

F30 Chassis Dynamics

6. Driving Stability Control

Index	Explanation
1	Driving experience control button

The F30 features the driving experience switch in the center console operating facility as standard.

The driver can use the driving experience control button to select different programs which alter various properties of the vehicle depending on the vehicle's equipment specification. The following programs are available:

- SPORT+
  Only in connection with at least one of the following optional equipment:
  - Sport Automatic transmission (optional equipment 2TB)
  - Variable sport steering (optional equipment 2VL)
  - Adaptive M sports suspension (optional equipment 2VF) or
  - BMW Sport Line (PA 7AC)
- SPORT
- COMFORT
- ECO PRO.

Drive systems	SPORT+	SPORT	COMFORT	ECO PRO
Accelerator characteristic	Sports	Sports	Normal	ECO PRO
Shift program (automatic transmission)	Sports	Sports	Normal	ECO PRO
Shift speed	Sports	Sports	Normal	Normal
Shift point display	none	none	Normal	ECO PRO

Chassis and suspension systems	SPORT+	SPORT	COMFORT	ECO PRO
Steering servo	Sport	Sport	Normal	Normal
Dynamic Stability Control	DTC on	DSC on	DSC on	DSC on
Electronic Damper Control	Sports	Sports	Comfortable	Comfortable

The Sports mode can be adapted by means of the Controller. It is possible to specify whether the Sports mode applies only to the chassis and suspension, only to the powertrain, or both.

ECO PRO supports a consumption-friendly driving style. In this regard, the engine control and convenience functions such as air-conditioning/heating are adapted. In addition, situation-dependent information can be shown which helps consumption-optimized driving. The extension of the range achieved can be shown in the instrument cluster.

Further information on ECO PRO can be found in the training information "F30 Display and Operating Elements".

Bayerische Motorenwerke Aktiengesellschaft
Händlerqualifizierung und Training
Röntgenstraße 7
85716 Unterschleißheim, Germany